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Nest Fermi Surface Segments, a Pseudogap and Nanoscale Fluctuating Charge/Orbital Ordering in Colossal Magnetoresistive (CMR) Oxides

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Using high resolution angle-resolved photoemission spectroscopy, we have made the first direct measurements of the key transport parameters of the metallic state of the CMR oxide $La_{1.2}Sr_{1.8}Mn_2O_7$, including the full two dimensional Fermi surface, the Fermi velocity v_F, the effective mass m^*, the mean free path λ, and the mean free time between scattering events τ. Using these parameters we are able to calculate the in-plane Drude conductivity, which turns out to be roughly one order of magnitude higher than the measured DC conductivity. A critical parameter absent from the Drude calculation is the pseudogap, which experimentally is found to remove huge portion of the spectral weight at E_F. A key piece of evidence as to the origin of the pseudogap is the Fermi surface, which we find to be dominated by parallel straight sections making it highly susceptible to nesting instabilities. The $\vec{Q}$ vectors that nest this Fermi surface correspond to those observed with short range order in diffraction experiments, making the presence of nanoscale fluctuating charge/orbital density wave gaps the likely origin of the pseudogap and a critical component to the physics of the CMR Oxides.